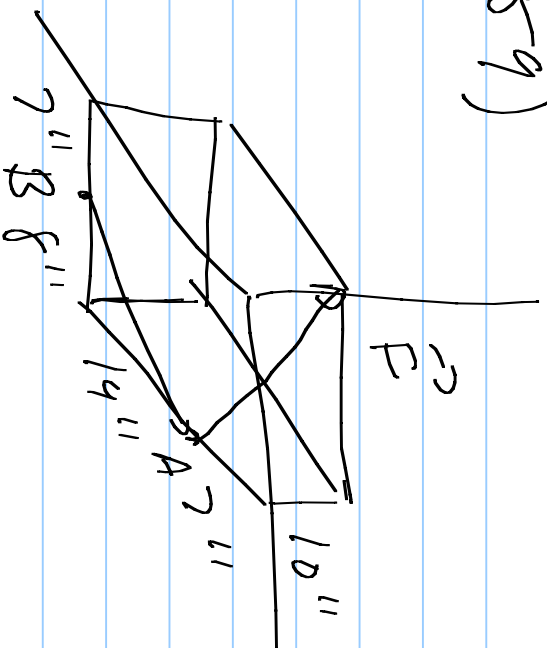


EGR 180

6111

4-59)



M_B

$$\vec{F} = 580 \left[-7\hat{i} - 15\hat{j} + 10\hat{k} \right] \sqrt{7^2 + 15^2 + 10^2}$$

$$\vec{r} = -14\hat{i} + 8\hat{j}$$

$$\vec{M}_B = \vec{r} \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -14 & 8 & 0 \\ -7 & -15 & 10 \end{vmatrix}$$

$$= \frac{580}{\sqrt{374}} \left[80\hat{i} + 140\hat{j} + 266\hat{k} \right]$$

→ 4198.0

$$M_B = 2399.30 + \underline{1558.09} + 7977.612$$

$$M_B = 9328.9 \text{ in-lbs}$$

$$\theta_x = \cos^{-1} \left(\frac{2399.3}{9328.9} \right) = 75.1^\circ$$

$$\theta_y = \cos^{-1} \left(\frac{1558.1}{9328.9} \right) = \cancel{95.0}^\circ \quad 63.3^\circ$$

$$\theta_z = \cos^{-1} \left(\frac{7977.6}{9328.9} \right) = 31.2^\circ$$

In 2D

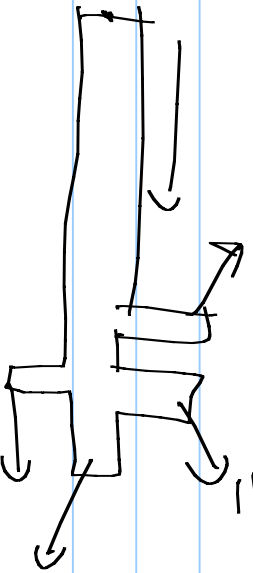
At single force and a point \rightarrow moment

A force is applied 2ft right and 3 feet

above a point of magnitude 60lbs at 4

angle of 35° from horizontal. Can you find the

moment. $M = -786.2 \text{ ft}\cdot\text{lbs}$



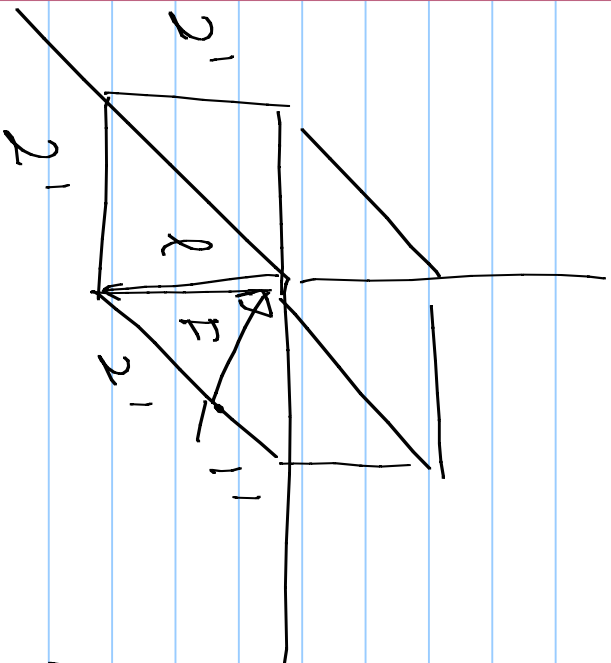
In 2D a series of forces, the resultant
Total force & location of the resultant

Some 3D problems $\vec{M} = \sum_i \vec{r}_i \times \vec{F}_i$

Moment about a line.

Parallel force system in 3D and find
location & mag of Resultant

$$F = 450 \text{ lbs}$$



M_D

$$\vec{M}_D = (\hat{i} + 2\hat{j}) \times 450 \left[\frac{2\hat{i} + 2\hat{k}}{2\sqrt{2}} \right]$$

$$\vec{M}_D = 225\sqrt{2} \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 0 \\ 1 & 0 & 1 \end{vmatrix} = 225\sqrt{2} [2\hat{i} - \hat{j} - 2\hat{k}]$$

$$\vec{r} = 2\hat{i} + 2\hat{j} \quad \vec{r} = \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j} \quad M_D = \vec{r} \cdot \vec{M}_D = 225 \text{ ft}\cdot\text{lbs}$$